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A KEY TO THE SPECIES OF OAKS OF EASTERN NORTH AMERICA BASED ON FOLIAGE AND TWIG CHARACTERS

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THERE is at present no adequate means for the identification of oaks by their leaves alone, without information concerning the fruit, twigs, bark, and other characteristics not ordinarily available on herbarium specimens. Since poor herbarium specimens and other more or less fragmentary material are constantly coming in for identification it was thought desirable to determine whether a practical key could be devised based on leaf characters only. After much detailed study of all of the various characters connected with the oak leaves such as the type, size, branching, spread, color, abundance, and distribution of the hairs, shape, size, thickness, and color of the leaf, size and shape of the upper epidermal cells, venation on the upper surface of the leaf, the distal angle between the principal veins and the midrib, and the length of the petiole, and after many trials, the appended key was prepared, which on testing has seemed to meet our needs. It is hoped that it may be of use to others faced with similar problems of identification.

The key was intended to include all the species and varities of oaks occurring east of the Mississippi River but owing to a lack of material *Q. microcarpa* Small and *Q. succulenta* Small were finally omitted.

The material forming the basis of this study was that in the herbarium of Cornell University and some sent in by botanists from various sections of the area covered. After the first draft of the key was made the material at the Gray Herbarium, the Arnold Arboretum, the New York Botanical Garden, the Field Museum, the

University of Minnesota, and the University of Michigan was examined as a check to the results previously obtained.

To render the key more easily usable a few explanatory notes are perhaps in order. Special attention should be called to the two fundamental types of hairs found on oak leaves. The most conspicuous is a non-glandular commonly branched type distributed over the surface of the leaf or confined to the veins or vein axils. This type itself falls into two subtypes, depending on the way in which the branches spread from the hair axis as to whether these branches spread all at one point or above one another. In addition to this non-glandular type there is generally another kind which is usually more minute and less conspicuous. These hairs are generally appressed or occasionally looser, and are usually of a distinctly stellate structure though rarely simple. The cell walls in these hairs are irregular and give a viscid impression as viewed under the microscope though there is little evidence of actual viscosity as indicated by debris attached to them. They have been designated "glandular hairs"[1] by other authors and the term is retained, but they should not be confused with the capitate type of glandular hairs to which the term is usually applied.

While many features of the various hairs may be seen by inspecting the leaf with a hand lens or low power microscope, for accurate study it is desirable to remove some of the hairs to a glass slide where they may be teased apart, covered with a cover glass and observed under higher magnification. For measuring the spread of the hair branches an eye-piece micrometer was used. For measuring the thickness of the leaves a cover-glass micrometer was employed.

1. Non-glandular hairs entirely absent from both surfaces of the leaf when mature. (A form of *Q. lyrata* is entirely glabrous except for a few non-glandular and almost simple hairs scattered along the midrib and veins beneath.) . . . . 2.
2. Upper epidermal cells markedly elongated over the smaller veinlets; apex and lobes of leaves rounded or notched, without bristle tips . . . . 3.
3. Base of leaf auricled . . . . . 1. *Q. robur* L.
3. Base of leaf rounded or cuneate . . . . 4.
4. Leaves 5–9-lobed with sinuses ½ or more of the way to the midrib, usually glaucous beneath and usually with minute appressed glandular hairs scattered over the lower surface . . . . . 2. *Q. alba* L.
4. Leaves entire or shallowly 3–13-lobed with the sinuses less than ½ of the way to the midrib, or 3-lobed with the sinuses about ½ of the way to the midrib . . . . 5.

[1] Engelmann, George. About the Oaks of the United States. Trans. St. Louis Acad. Sci. **3**: 372–400. 1868–77 (Repr. "Botanical Works," Ed. Wm. Trelease and Asa Gray. 1887).

5. The leaves 3–13-lobed with sinuses one third or more of the way to the midrib or rarely entire. .....3. *Q. austrina* Small.
5. The leaves entire or shallowly 3–5-lobed with the sinuses less than one third of the way to the midrib .....4. *Q. Durandii* Buckl.

2. Upper epidermal cells slightly elongated or isodiametric over the smaller veinlets; apex of leaf acute and usually bristle-tipped .....5. *Q. laurifolia* Michx.

1. Non-glandular hairs present on one or both surfaces of the leaf though often confined to the veins or even vein axils....6.

6. Leaves with non-glandular hairs distributed over the lower surface or scattered along the midrib and principal veins, rarely in conspicuous tufts in the axils of the veins and then the lower surface densely pubescent....7.

7. Branches of the non-glandular hairs spreading at the same distance from the surface of the leaf, the hairs loose or appressed; leaves usually without bristle tips....8. WHITE OAKS (except No. 26).

8. Non-glandular hairs sessile or very nearly so, appressed or loose....9.

9. Leaves entire or shallowly lobed with the sinuses usually less than one third of the way to the midrib. (Sometimes deeply 3-lobed near the middle in No. 3.)....10.

10. Upper epidermal cells markedly elongated over the smaller veinlets....11.

11. Margin of leaves entire or shallowly 3–5-lobed....12.

12. The leaves yellowish or grayish brown beneath; glandular hairs usually present; non-glandular hairs scattered over the upper surface or sometimes only on the midrib; glandular and non-glandular hairs present on the petiole....13.

13. Petioles more than 5 mm. long; leaves shallowly 3–5-lobed; twigs scurfy pubescent .....
21. *Q. stellata* Wang., var. *Boyntonii* (Beadle) Sarg.

13. Petioles usually less than 5 mm. long; leaves entire or shallowly 3-lobed toward the apex; twigs nearly smooth... .....6. *Q. Chapmanii* Sarg.

12. The leaves silvery white or pale green beneath; glandular hairs absent; upper surface glabrous or sometimes a few non-glandular hairs near the base of the midrib; petioles glabrous or sometimes with a few non-glandular hairs....14.

14. Leaves silvery white and densely pubescent beneath, or pale green with non-glandular hairs scattered over the entire lower surface; leaves entire or but slightly lobed at the apex ....4. *Q. Durandii* Buckl.

14. Leaves pale green beneath, with non-glandular hairs scattered along the midrib and veins beneath; leaves shallowly 3–5-lobed .....3. *Q. austrina* Small.

11. Margin of leaves coarsely serrate, deeply sinuate-dentate, or crenate-serrate....15.

15. Non-glandular hairs on the lower surface of the leaf of two sizes mixed (the larger loose, 2–8-branched with a spread of 0.40–0.60 mm., the smaller appressed, (2)–4–8-branched with a spread of 0.15–0.30 mm.); or all large, loose, and 8–15-branched with a spread of 0.20–0.40 mm....16.
16. Non-glandular hairs on the lower surface of the leaf gray; some of the principal veins ending in the sinuses.....7. *Q. bicolor* Willd.
16. Non-glandular hairs on the lower surface of the leaf of two colors, small ones gray and the larger ones yellow; principal veins ending in the lobes.....12. *Q. prinoides* Willd., var. *rufescens* Rehder.

15. Non-glandular hairs on the lower surface of the leaf all of about the same size, small, appressed; or if larger, then loose with a spread of 0.20–0.40 mm. and simple or 2–4–(5)-branched....17.
17. Leaves with a pair of sinuses about the middle or below wider and deeper than the others; some of the principal veins often ending in the sinuses.18. *Q. macrocarpa* (form)
17. Leaves with sinuses essentially uniform; principal veins ending in the lobes....18.
18. Non-glandular hairs on the lower surface of the leaf a mixture of simple, 2–3 or – 4-branched hairs, rarely with a few 5-branched hairs mixed with others, the 5-branched hairs when present loose with a spread of more than 0.20 mm.....19.
19. Spread of the non-glandular hairs on the lower surface of the leaf 0.08–0.20 mm., mostly appressed; lower surface of the leaf rough to the touch; minute appressed glandular hairs usually scattered over the lower surface.....8. *Q. montana* Willd.
19. Spread of the non-glandular hairs on the lower surface of the leaf 0.20–0.40 mm., loose; lower surface of the leaf soft to the touch; glandular hairs usually absent.....9. *Q. Prinus* L.
18. Non-glandular hairs on the lower surface of the leaf a mixture of 4–12-branched appressed hairs with a spread of usually less than 0.20 mm.....20.
20. Leaves with 8–13 teeth on each side (sometimes small leaves with 6 teeth on each side on the same twig with the large leaves); teeth usually acute.....10. *Q. Muhlenbergii* Engelm.
20. Leaves with 5–8 teeth on each side, teeth usually obtuse....11. *Q. prinoides* Willd.

10. Upper epidermal cells not markedly elongated over the smaller veinlets....21.
21. Non-glandular hairs on the lower surface of the leaf loose, with a spread of 0.20–0.40

mm.; leaves strongly reticulate-venulose on the lower surface. . . . . .14. *Q. virginiana* Mill., var. *geminata* (Small) Sarg.

21. Non-glandular hairs on the lower surface of the leaf appressed, with a spread of 0.10–0.20 mm.; leaves less strongly reticulate-venulose on the lower surface. (Larger and broader leaves somewhat more reticulate.) . . . .22.

22. Leaves usually entire. . . . . .13. *Q. virginiana* Mill.

22. Leaves repand-dentate or the upper ones sometimes entire. . . . . .15. *Q. virginiana* Mill., var. *dentata* (Chapm.) Sarg.

9. Leaves lobed with the sinuses more than one third of the way to the midrib. (If 3-lobed, the lobes above the middle.) . . . .23.

23. Base of leaf auricled. . . . . .1. *Q. robur* L.

23. Base of leaf rounded or cuneate. . . .24.

24. Petiole pubescent, usually scurfy; non-glandular hairs on the petiole a mixture of 4–8-branched hairs. . . .25.

25. Non-glandular hairs on the lower surface of the leaf of two sizes mixed (the larger loose, 2–8-branched with a spread of 0.30–0.60 mm., the smaller appressed, 4–8-branched with a spread of 0.15–0.30 mm.) . . . . . .7. *Q. bicolor* Willd.

25. Non-glandular hairs on the lower surface of the leaf all of about the same size. . . .26.

26. Leaves silvery white beneath with appressed non-glandular hairs dense, or scattered over the entire surface; glandular hairs absent or inconspicuous; more than three pairs of principal veins ending in the lobes, others ending in the sinuses. . . . . .16. *Q. macrocarpa* Michx. and 17. var. *olivaeformis* (Michx. f.) Gray.

26. Leaves tawny beneath with loose non-glandular hairs scattered along the midrib and veins; glandular hairs usually dense beneath giving a yellowish appearance to the surface of the leaf; only two or three pairs of principal veins ending in the lobes. . . .27.

27. Leaves with 5–(7) diverging lobes, the base short-cuneate or rounded. . . . . .19. *Q. stellata* Wang.

27. Leaves with 3 ascending lobes, the base long-cuneate. . . . . .20. *Q. stellata* Wang., var. *paludosa* Sarg.

24. Petiole usually glabrous, sometimes with a few simple or 2-branched non-glandular hairs. . . .28.

28. Leaves with glandular hairs absent on the lower surface. . . .29.

29. Lower surface of leaf silvery white; non-glandular hairs usually dense on the lower surface of the leaf. . . . . .22. *Q. lyrata* Walt.

29. Lower surface of leaf pale green; non-glandular hairs scattered over the lower surface or only on the midrib and veins. . . . . .23. *Q. lyrata* Walt. f. *viridis* Trel.

28. Leaves with minute appressed glandular hairs scattered over the lower surface . . . . . 2. *Q. alba* L.
8. Non-glandular hairs distinctly pedicellate (pedicel 4 or more times the width of the hair branch), loose . . . . 30.
30. Leaves 3–8-lobed . . . . 31.
31. Non-glandular hairs on the lower surface of the leaf all cream colored . . . . . 24. *Q. stellata* Wang., var. *Margaretta* (Ashe) Sarg.
31. Non-glandular hairs along the midrib and veins beneath yellowish, others cream colored . . . . . 25. *Q. stellata* Wang., var. *arinosa* Sarg.
30. Leaves entire except on vigorous shoots, then toothed . . . . 32.
32. Leaves 0.18–0.35 mm. thick with strongly revolute margins and without bristle tips; non-glandular hairs on the lower surface of the leaf of two sizes mixed (the larger, loose, the smaller, appressed) . . . . . 14. *Q. virginiana* Mill., var. *geminata* (Small) Sarg.
32. Leaves 0.07–0.14 mm. thick, without revolute margins, and with bristle tips; non-glandular hairs on the lower surface of the leaf all of about the same size, usually with a very long pedicel . . . . . 26. *Q. imbricaria* Michx.
7. Branches of the non-glandular hairs spreading at different distances from the surface of the leaf (the uppermost often forming a whorl, the internodes often suppressed giving a "burr-like" appearance to the hair); leaves usually with bristle tips . . . . 33. BLACK OAKS.
33. Leaves entire or slightly lobed on vigorous shoots . . . . 34.
34. Ultimate veinlets raised on the upper surface of the leaf; leaves with 9–13 or more pairs of principal veins; tufts of hairs absent in the axils of the veins beneath . . . . . 27. *Q. pumila* Walt.
34. Ultimate veinlets sunken on the upper surface of the leaf; leaves with 6–9 pairs of principal veins; tufts of brownish hairs sometimes present in the axils of the veins beneath . . . . . 28. *Q. cinerea* Michx.
33. Leaves lobed . . . . 35.
35. Lower surface of leaf usually densely tomentose; glandular hairs when present more or less hidden among the non-glandular hairs . . . . 36.
36. Leaves 3–7 (usually 3–5)-lobed the sinuses broad and shallow . . . . 37.
37. Lower surface of leaf canescent, base cuneate. . . . . 29. *Q. ilicifolia* Wang.
37. Lower surface of leaf tawny, base usually rounded . . . . . 32. *Q. rubra* L., f. *triloba* (Michx.) Ashe.
36. Leaves 3–11 (usually 5–11)-lobed the sinuses broad and deep . . . . 38.
38. Leaves with terminal lobe much elongated and all of the lobes more or less falcate; usually tawny beneath . . . . . 30. *Q. rubra* L.
38. Leaves with all of the lobes about equal, usually not falcate, canescent beneath . . . . . 31. *Q. rubra* L., var. *pagodaefolia* Ashe.
35. Leaves with scattered pubescence beneath; appressed amber-colored glandular hairs usually present beneath and conspicuous, either over the entire lower surface or along the midrib and veins . . . . . 33. *Q. velutina* Lam.

6. Leaves with non-glandular hairs in tufts which are in the axils of some or all of the primary veins beneath or extending along the midrib and in some species also scattered over the lower surface. (In some species the tufts are very small, consisting of only a few hairs in some of the primary vein axils.) . . . . . 39. BLACK OAKS.
39. The leaves entire or shallowly 3–5-lobed . . . . 40.
40. Leaves markedly dilated upward, usually with hairy petioles . . . . 41.
41. Lower surface of leaf yellow-brown or conspicuously yellow-green, scurfy with appressed branched amber-colored glandular hairs; leaves sometimes shallowy 3–5-lobed; base of leaf narrowly rounded or cordate . . . . . 34. *Q. marilandica* Muench.
41. Lower surface of leaf pale-green but not conspicuously yellow-green; glandular hairs when present not conspicuous; base of leaf cuneate . . . . 42.
42. Leaves entire or undulate at the apex . . . . . 35. *Q. nigra* L.
42. Leaves 3-lobed at the apex . . . . . 36. *Q. nigra* L., var. *tridentifera* Sarg.
40. Leaves not markedly dilated upward; petiole usually glabrous . . . . 43.
43. Upper epidermal cells markedly elongated over the ultimate veinlets . . . . . 35. *Q. nigra* L.
43. Upper epidermal cells slightly elongated or isodiametric over the ultimate veinlets . . . . 44.
44. Leaves with cream- to amber-colored glandular hairs and also sometimes non-glandular hairs scattered over the lower surface; leaves 2–5 cm. long, oval to oblong-obovate, with strongly revolute margins . . . . . 37. *Q. myrtifolia* Willd.
44. Leaves with glandular hairs absent on the lower surface, non-glandular hairs usually confined to tufts or sometimes scattered along the sides of the midrib beneath; leaves 4–13 cm. long, ovate-lanceolate, elliptic-lanceolate, or rhombic (rarely oblong-obovate), without strongly revolute margins (slightly revolute in *Q. laurifolia*) . . . . 45.
45. Leaves ovate-lanceolate, sometimes oblong-obovate with 3–5 coarse teeth toward the apex, somewhat glossy above and dull beneath . . . . . 38. *Q. phellos* L.
45. Leaves elliptic-lanceolate or rhombic, glossy on both surfaces . . . . 46.
46. Leaves yellow-green and elliptic-lanceolate in outline . . . . . 5. *Q. laurifolia* Michx.
46. Leaves blue-green and rhombic, sometimes broadest above the middle . . . . . 39. *Q. laurifolia* Michx., var. *rhombica* Trel.

39. The leaves deeply 3–13-lobed or if shallowly lobed with 5–7 lobes . . . . 47.
47. Petiole of larger leaves from 0.2–1.5 cm. long . . . . 48.
48. Leaves with petioles less than 0.5 cm. long . . . . . 35. *Q. nigra* L. (form).
48. Leaves with petioles from 0.5–1.5 cm. long . . . . 49.
49. The leaves 0.12–0.22 mm. thick, usually falcately lobed, and usually very glossy on the upper surface; midrib broad, one millimeter or more wide at the base, raised on the upper surface . . . . . 40. *Q. Catesbaei* Michx.

49. The leaves 0.07–0.11 mm. thick, the lobes usually nearly or quite straight, glossy above but not conspicuously so; midrib slender, less than one millimeter wide at the base . . 41. *Q. georgiana* M. A. Curtis.

47. Petiole of larger leaves from 1.5–7.5 cm. long. (Usually 2–7.5 cm. long) . . . . 50.

50. Non-glandular hairs in the axils of the veins beneath a mixture of 10–20-branched hairs . . . . 51.

51. Principal leaf lobes or some of them with one or two small bristles on the sides of the lobe less than 5 mm. from the apex; lobes rather blunt . . . . 52.

52. Leaves with upper principal pair of sinuses narrow and curving forward, all sinuses usually rounded at the base; principal veins, except the lowest pair, nearly or quite straight, ascending or diverging; bud scales usually gray . . . . . 42. *Q. Shumardii* Buckl. and 43. *Q. Shumardii* Buckl., var. *Schneckii* (Britton) Sarg.

52. Leaves with upper principal pair of sinuses wide and spreading, some of the sinuses truncate at the base; principal veins usually curved, diverging, lowest pair usually more strongly curved; bud scales reddish brown. . . . . 44. *Q. palustris* Muench.

51. Principal leaf lobes without small bristles on the sides of the lobe less than 5 mm. from the apex; lobes usually long-tapering . . . 45. *Q. Nuttallii* E. J. Palmer.

50. Non-glandular hairs in the axils of the veins beneath a mixture of 4–8–(10)-branched hairs . . . . 53.

53. Burr-like non-glandular hairs usually scattered over the lower surface or along the midrib in addition to the non-glandular hairs in the tufts in the vein axils; midrib pubescent on the upper surface of the leaf; amber glandular hairs usually present on the lower surface of the leaf, scattered over the surface or only along the midrib and veins; petioles scurfy pubescent all over or only on the upper side, sometimes only near the base, rarely glabrous; buds densely gray tomentose . . . . . 33. *Q. velutina* Lam.

53. Burr-like non-glandular hairs usually absent on the lower surface of the leaf, when present confined to the tufts in the vein axils; midrib usually glabrous on the upper surface of the leaf; glandular hairs absent; petiole usually glabrous, sometimes with a few scattered non-glandular hairs; buds glabrous or only pubescent above the middle . . . . 54.

54. Principal lobes of the leaf usually broadest at the base, tapering toward the apex; length of the lobes less than or equalling the width of the broad middle portion of the leaf (rarely one and one half times the middle portion) . . . . . 46. *Q. borealis* Michx. f. and 47. *Q. borealis*, var. *maxima* (Marsh.) Ashe.

54. Principal lobes of the leaf broadest at the apex or with the sides nearly or quite parallel; the length of the largest lobes two or more times the width of the narrow middle portion of the leaf . . . . 55.

55. Trees of uplands; winter buds red or orange-brown....56.
56. Range from northwestern Indiana to Manitoba, south to northern Missouri; winter buds usually glabrous and shining.....48. *Q. ellipsoidalis* E. J. Hill.
56. Range from Maine and southern Ontario to southern Nebraska, southward to North Carolina, Alabama and Arkansas; winter buds usually pubescent toward the tip.....49. *Q. coccinea* Muench.
55. Trees of lowlands; winter buds reddish-gray or gray.....42. *Q. Shumardii* Buckl. and 43. *Q. Shumardii* Buckl., var. *Schneckii* (Britton) Sarg.

4. Q. DURANDII Buckl. Two forms of this species occur, one with leaves green beneath and the other with leaves white-tomentose on the lower surface. Trelease[1] has considered these as mesophytic and xerophytic forms respectively. Dr. E. J. Palmer states that he has found both leaf forms on the same tree which would indicate that the variations are of little ecological or taxonomic importance.

7. Q. BICOLOR Willd. Here, as in *Q. Durandii*, two leaf types as to pubescence occur, one green and the other white-tomentose beneath. Trelease has considered these as mesophytic and xerophytic forms with the implication that the first one is a woodland form but this point needs further study. This green form has been designated by Trelease as var. *mollis* Nutt.

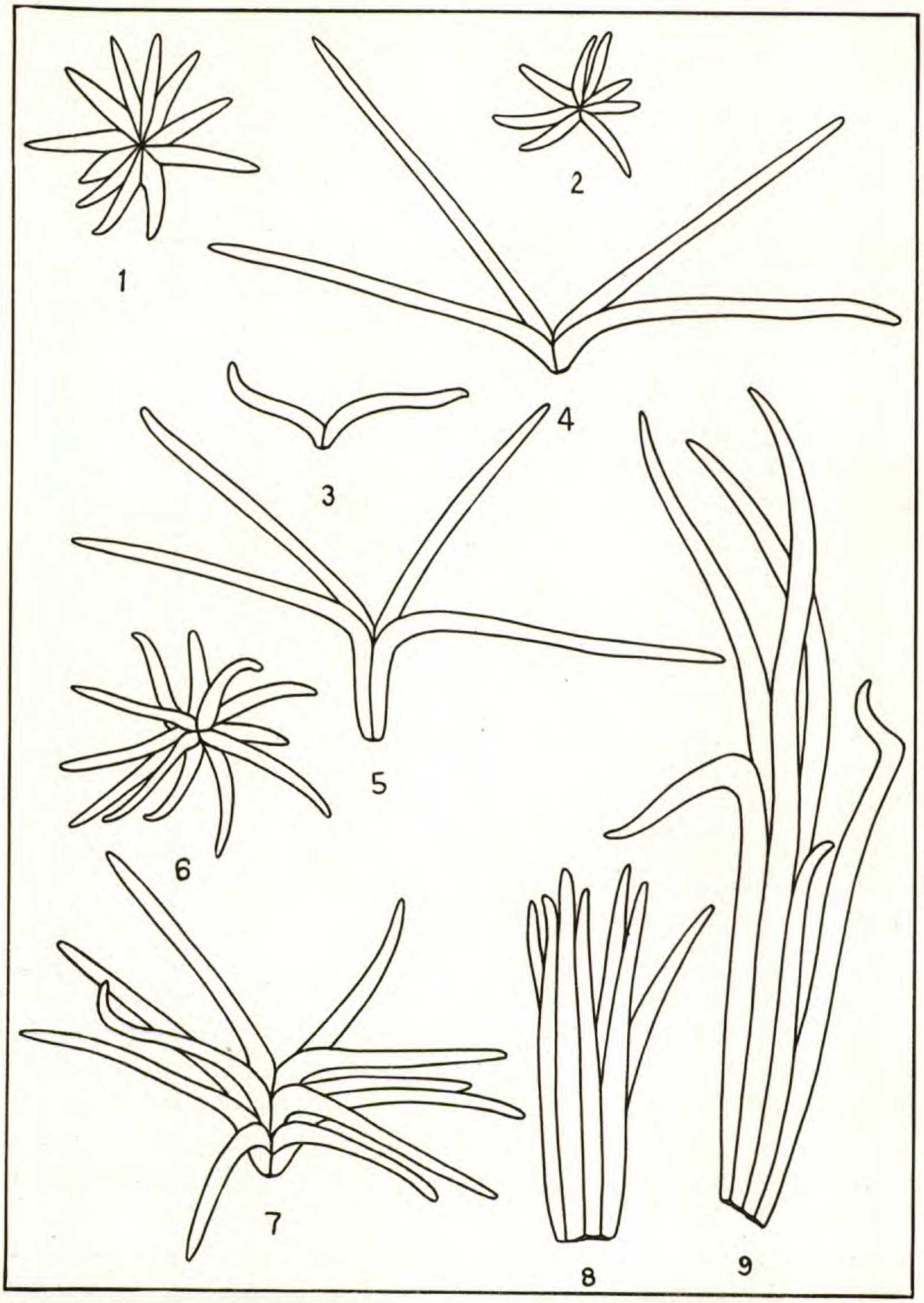
8. Q. MONTANA Willd. *Q. Prinus* L. of most authors (see Sargent, RHODORA, **17**, 40, 1915).

9. Q. PRINUS L. *Q. Michauxii* Nutt. of most authors (see Sargent, RHODORA, **17**, 40, 1915).

14. Q. VIRGINIANA Mill., var. GEMINATA (Small) Sarg.[2] This is recognized as a distinct species by Small and undoubtedly it lies on the border line as to distinctness. The much larger hairs may be added in support of Small's contention, but the general variability of foliage and habit in this species has seemed to indicate the desirability of a conservative point of view at least for the present. A low form with more repand-serrate leaves may be recognized as var. *dentata* (Chapm.) Sarg. The hairs in this variety resemble those of the typical form but tend to have fewer branches. Other leaf forms have been recognized as distinct varieties by Sargent but are of doubtful taxonomic value.

22. Q. LYRATA Walt. As in *Q. Durandii* and *Q. bicolor* there is in this species also a green and a whitened leaf form. Whether these are woodland and exposed types as suggested by Trelease should be more fully investigated.

[1] Trelease, Wm. The American Oaks. Mem. Nat. Acad. Sci. **20**: 7. 1924.
[2] Sargent, C. S. Bot. Gaz. **65**: 445, 446, 1918.



NON-GLANDULAR HAIRS OF QUERCUS

WHITE OAK TYPE: FIG. 1, *Q. virginiana* and FIG. 2, *Q. Muhlenbergii*, top view of sessile appressed hair; FIG. 3, *Q. montana* and FIG. 4, *Q. stellata*, side view of sessile hair; FIG. 5, *Q. imbricaria*, side view of pedicellate hair.

BLACK OAK TYPE: FIG. 6, *Q. cinerea*, top view; FIG. 7, *Q. velutina*, side view.

VEIN AXIL TYPE: FIG. 8, *Q. borealis* and FIG. 9, *Q. velutina*, side view.

24. Q. STELLATA Wang., var. MARGARETTA (Ashe) Sarg. This form has been treated variously, as a species, as a variety and as a possible hybrid of *Q. alba* and *Q. stellata*. In opposition to the latter interpretation may be mentioned the pedicellate hairs which are sessile in both of the supposed parents, and the absence of glandular hairs which are found on the leaves of both parents. Also there is a denser pubescence on the mature leaves than on either *Q. alba* or *Q. stellata*. On the other hand there is little to warrant its recognition as a species. The difference in acorn size emphasized by Small does not seem to exist in our specimens. The variation in leaf shape and in the pedicel of the hair seems scarcely sufficient to constitute a species without other supporting characters.

26. Q. IMBRICARIA Michx. This is the only black oak studied having the white oak hair type but it is easily distinguished from the other entire-leaved oaks both black and white by the large pedicellate non-glandular hairs on the lower surface of the leaf.

Three specimens of the so-called *Q. Leana* Nutt. (one from Biltmore, N. C. and two from Ohio) are at hand. *Q. Leana* is usually interpreted as a hybrid of *Q. velutina* and *Q. imbricaria*. These specimens are interesting from the standpoint of hair types with reference to the supposed parentage. When the leaves are young the upper surface is furnished with the "burr-like" hairs of the black oak group (including *Q. velutina*) while the hairs of the lower surface are of the *imbricaria* type. At maturity the upper surface of the leaves has become entirely glabrous but the lower surface is still tomentose with the *imbricaria* type of hair. These hair types seem to support the supposed hybrid parentage.

28. Q. CINEREA Michx. The leaves of this species are often confused with those of *Q. virginiana* but the hairs are very different and serve as a good means of identification.

30. Q. RUBRA L. *Q. falcata* Michx. of many authors (see Sargent, RHODORA, **18**: 45, 1916).

46. Q. BOREALIS Michx. f., var. MAXIMA (Marsh.) Ashe. *Q. rubra* of many authors (see Ashe, Proc. Soc. Am. Foresters, **11**: 90, 1916). This variety is not separable from the typical form of the species on leaf characters alone.

48. Q. ELLIPSOIDALIS E. J. Hill. Owing to the similarity in leaf characters of this species, *Q. coccinea*, *Q. Shumardii*, and *Q. Shumardii* var. *Schneckii*, it was considered best to separate these species on habitat, bud characters, and distribution.

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